We claim:

1. A CPP spin-valve element formed on a substrate comprising:

a free layer structure including at least one ferromagnetic layer;

a pinned layer structure including at least one ferromagnetic layer, the free layer is magnetically softer than the pinned layer;

a thin non-magnetic spacer layer structure configured to separate the free layer and the pinned layer, to prevent a magnetic coupling between the free and pinned layer structures, and to allow an electric current to go there through; and

wherein at least two current-confining (CC) layer structures including at least two parts having significantly different current conductivities are incorporated therein.

2. The CPP spin-valve element of claim 1, wherein said pinned layer structure includes one of:

a single ferromagnetic layer with a higher coercivity than the free layer structure,

a ferromagnetic layer exchange coupled with an antiferromagnetic layer, or

a sandwiched structure including a ferromagnetic layer, a non-magnetic layer, and a ferromagnetic layer, wherein one of the ferromagnetic layers is exchange coupled with an antiferromagnetic layer.

3. The CPP spin-valve element of claim 1, wherein said CC-layer structure includes a mosaic structure of conducting and insulating parts.

4. The CPP spin-valve element of claim 3, wherein said mosaic structure includes metal and oxide.

5. The CPP spin-valve element of claim 4, wherein said metal is selected from the group consisting of Ag, Al, Au, Co, Cr, Cu, Fe, Mg, Mn, Nb, Ni, Pd, Pt, Ta, Ti, V, Zr and their

alloys and said oxide is selected from the group consisting of the oxides of Al, Co, Cr, Cu, Fe, Mg, Mn, Nb, Ni, Pd, Si, Ta, Ti, V, and Zr.

6. The CPP spin-valve element of claim 3, wherein said mosaic structure includes metal and nitride.

7. The CPP spin-valve element of claim 6, wherein said metal is selected from the group consisting of Ag, Al, Au, Co, Cr, Cu, Fe, Mn, Ni, Pd, Pt, Ta and their alloys and said nitride is selected from the group consisting of the nitrides of Al, B, C, Si, and Ta.

8. The CPP spin-valve element of claim 1, wherein one of said CC-layer structures is located within or in the vicinity of said free layer structure and another of said CC-layer structures is located within or in the vicinity of said pinned layer structure.

9. The CPP spin-valve element of claim 1, wherein a bulk spin asymmetry coefficient, β, of a ferromagnetic layer of said ferromagnetic layer structures is greater than the interface spin asymmetry coefficient, γ, between a ferromagnetic layer of said ferromagnetic layer structures and a non-magnetic layer; and at least one of said CC-layer structures is located within the ferromagnetic layer of said ferromagnetic layer structure.

10. The CPP spin-valve element of claim 1, wherein an interface spin asymmetry coefficient, γ, of a ferromagnetic layer of said ferromagnetic layer structures and a non-magnetic layer is greater than a bulk spin asymmetry coefficient, β, of said ferromagnetic layer; and at least one of said CC-layer structures is located at or in the vicinity of the interface of either side of the ferromagnetic layer of said ferromagnetic layer structure.

11. The CPP spin-valve element of claim 1, wherein a bulk spin asymmetry coefficient, β, of both said free layer and pinned structures is greater than an interface spin asymmetry coefficient, γ, and at least one of said CC-layer structures is located within the ferromagnetic layer of said free layer structure and at least another of said CC-layer structures is located within the ferromagnetic layer of said pinned layer structure.

12. The CPP spin-valve element of claim 1, wherein an interface spin asymmetry coefficient, γ, between each ferromagnetic layer of both said ferromagnetic layer structures is greater than a bulk spin asymmetry coefficient, β, and at least one of said CC-layer structures is located at or in the vicinity of the interface of either side of said free layer structure and at least another of said CC-layer structures is located at or in the vicinity of the interface of either side of said pinned layer.

13. The CPP spin-valve element of claim 1, wherein the width of the confined current paths of said CC-layer structures is greater than the power of 1.5 of the thickness measured in nano-meters of said ferromagnetic layers which include or lie next to said CC-layer structures.

14. The CPP spin-valve element of claim 1, wherein the width of the confined current paths of said CC-layer structures is greater than two times the power of 1.5 of the thickness measured in nano-meters of said ferromagnetic layers which include or lie next to said CC-layer structures.

15. The CPP spin-valve element of claim 1, wherein at least one confined-current path is formed within every flux path of a width of an exchange length of the free layer except at side edges of the free layer.

16. The CPP spin-valve element of claim 1, wherein a pair of CC-layer structures are located on both sides across said free layer structure or said pinned layer whose conducting parts are located in a cascade manner, and at least the inner edge to edge distance of a projection of the conducting parts of the CC-layers forming at least one of the current paths through at least one of said free layer structure and said pinned layer onto the layer plane is made greater than the thickness of at least one of said free layer structure and said pinned layer.

17. The CPP spin-valve element of claim 1, wherein a pair of CC-layer structures are located on both sides across said free layer structure or said pinned layer whose conducting

parts are located in a cascade manner, and the length of at least one of the current paths through at least one of said free layer structure and said pinned layer structure is greater than a half of a spin diffusion length in at least one of said free layer structure and said pinned layer structure and is smaller than 3 times as large as a spin diffusion length.

18. The CPP spin-valve element of claim 17, wherein said length of at least one of the current paths through at least one of said free layer structure and said pinned layer structure is greater than the spin diffusion length in at least one of said free layer structure and said pinned layer structure and is smaller than 2 times as large as the spin diffusion length of said current paths.

19. A CPP spin-valve element formed on a substrate comprising:

a free layer structure including at least one ferromagnetic layer;

a pinned layer structure including at least one ferromagnetic layer, the free layer is magnetically softer than the pinned layer; and

a thin non-magnetic current confining (CC)-layer structure configured to separate the free and pinned layers, to prevent a substantial magnetic coupling between said free and pinned layer structures, and to allow an electric current to go through the confined current paths;

wherein the width of the confined current paths of said CC-layer structure is greater than the power of 1.5 of the thickness of at least one of said free layer structure and said pinned layer measured in nano-meters.

20. The CPP spin-valve element of claim 19, wherein the width of the confined current paths of said CC-layer structure is greater than two times the power of 1.5 of the thickness of at least one of said free layer structure and pinned layer measured in nano-meters.

21. A CPP spin-valve element formed on a substrate comprising:

a free layer structure including at least one ferromagnetic layer;

a pinned layer structure including at least one ferromagnetic layer, the free layer is magnetically softer than the pinned layer; and

a thin non-magnetic current confining (CC)-layer structure configured to separate the free and pinned layers, to prevent a substantial magnetic coupling between said free and pinned layer structures, and to allow an electric current to go through the confined current paths;

wherein another CC-layer structure is incorporated therein.

22. The CPP spin-valve element of claim 21, wherein said another CC-layer structure is placed across at least one of the free layer and the pinned layer.

23. The CPP spin-valve element of claim 21, wherein the width of the confined current paths of said CC-layer structures is greater than the power of 1.5 of the thickness of at least one of said free layer structure and said pinned layer measured in nano-meters.

24. The CPP spin-valve element of claim 21, wherein the width of the confined current paths of said CC-layer structures is greater than two times the power of 1.5 of the thickness of at least one of said free layer structure and said pinned layer measured in nano-meters.

25. The CPP spin-valve element of claim 22, wherein conducting parts of said CC-layers are located in a cascade manner and at least an inner edge to edge distance of a projection of the conducting parts of the CC-layers forming at least one of the current paths through said free layer structure or said pinned layer onto the layer plane is made greater than the thickness of at least one of said free layer structure and said pinned layer.

26. The CPP spin-valve element of claim 22, wherein the length of at least one of the current paths through at least one of said free layer structure and said pinned layer structure is greater than a half of a spin diffusion length in at least one of said free layer structure and said pinned layer and is smaller than 3 times as large as the spin diffusion length.

27. The CPP spin-valve element of claim 26, wherein the length of at least one of the current paths through at least one of said free layer structure and said pinned layer structure is greater than a spin diffusion length in at least one of said free layer structure and said pinned layer and is smaller than 2 times as large as the spin diffusion length.

28. A CPP spin-valve element formed on a substrate comprising:

a free layer structure including at least one ferromagnetic layer;

a pinned layer structure including at least one ferromagnetic layer, the free layer is magnetically softer than the pinned layer; and

a thin non-magnetic conducting layer structure configured to separate the free and pinned layers, to prevent a substantial magnetic coupling between said free and pinned layer structures, and to allow an electric current to go through the confined current paths;

wherein at least one CC-layer structure is incorporated therein, the width of at least one of the confined current paths of said CC-layer structure is greater than the power of 1.5 of the thickness of at least one of said free layer structure and pinned layer measured in nano-meters.

29. The CPP spin-valve element of claim 28, wherein the width of at least one of the confined current paths of said CC-layer structure is greater than two times the power of 1.5 of the thickness of at least one of said free layer structure and pinned layer measured in nano-meters.

30. A CPP spin-valve element formed on a substrate comprising:

a free layer structure including at least one ferromagnetic layer;

a pinned layer structure including at least one ferromagnetic layer, the free layer is magnetically softer than the pinned layer;

a thin non-magnetic current confining (CC)-layer structure configured to separate the free and pinned layers, to prevent a substantial magnetic coupling between said free and pinned layer structures, and to allow an electric current to go through the confined current paths; and

lead layers configured to be connected to electrodes;

wherein at least said non-magnetic layer and said pinned layer structure are formed in a CC-layer structure forming at least.

31. The CPP spin-valve element of claim 30, wherein the width of at least one of the confined current paths of said CC-layer structure is greater than the power of 1.5 of the thickness of said free layer structure measured in nano-meters.

32. The CPP spin-valve element of claim 30, wherein the width of at least one of the confined current paths of said CC-layer structure is greater than two times the power of 1.5 of the thickness of said free layer structure.

33. The spin-valve element of claim 30, wherein at least another CC-layer structure is incorporated across the free layer structure.

34. The spin-valve element of claim 33, wherein at least said another CC-layer structure is incorporated across the free layer structure, the width of at least one of the confined current paths of said CC-layer structure is greater than the power of 1.5 of the thickness of said free layer structure measured in nano-meters.

35. The CPP spin-valve element of claim 33, wherein the width of at least one of the confined current paths of said CC-layer structure is greater than two times the power of 1.5 of the thickness of said free layer structure measured in nano-meters.

36. The CPP spin-valve element of claim 33, wherein conducting parts of the CC-layers facing across said free layer structure are located in a cascade manner, and a

projection of the length of at least one of the current paths through said free layer structure onto the layer plane is made greater than the thickness of said free layer structure.

37. The CPP spin-valve element of claim 33, wherein said length of at least one of the current paths through said free layer structure is greater than a half of a spin diffusion length in said free layer structure or said pinned layer structure and smaller than 3 times as large as the spin diffusion length.

38. The CPP spin-valve element of claim 37, wherein said length of at least one of the current paths through said free layer structure is greater than the spin diffusion length in said free layer structure and smaller than 2 times as large as the spin diffusion length.

39. The CPP spin-valve element of claim 1, wherein said CC-layer structures are fabricated with a lithography technique using an electrochemical scanning probe.